



# Hepatitis B vaccination status among healthcare workers in a tertiary care hospital in Tripoli, Libya

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## KEYWORDS

Hepatitis B vaccination;  
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## Summary

**Background:** The prevalence of hepatitis B virus (HBV) among healthcare workers (HCWs) in hospitals in developing countries is high. However, the vaccination status of these workers and its relationship with occupational factors are not well documented.

**Aim:** The aim of this study was to evaluate the susceptibility of HCWs to HBV infection in the representative Tripoli Central Hospital in Libya and prepare a practical guideline to protect HCWs from occupational exposure.

**Method:** In this cross-sectional study, a questionnaire survey was administered to 2705 healthcare workers of a university hospital in Tripoli. The questionnaire included vaccination status. Compliance with preventive practices against HBV infection was also assessed.

**Result:** The overall vaccination coverage (anti-HBs) was 78.1%. Furthermore, 82.6% of HCWs had received at least one dose of vaccine, but only 72% reported that they were fully vaccinated. The prevalence of hepatitis B surface antigen was 1.1%. The mean prevalence of hepatitis B core antibody (anti-HBc) was 17.3%.

**Conclusion:** HCWs at hospitals are frequently exposed to blood-borne infections. Vaccines should be more readily available for Libyan HCWs, and current vaccination programs should be enforced.

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## Introduction

Occupational exposure to hepatitis B virus (HBV) is a well-recognized risk for healthcare workers

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(HCWs), and it is dependent on the frequency of percutaneous and permucosal exposure to blood or body fluids containing blood, which commonly occurs due to needle sticks or other sharp device injuries (NSIs). The frequency of HCW exposure to HBV is influenced by HBV endemicity. Thus, 90% of such HBV infections occur in Asia and Africa [1–4]. A majority of countries in the Middle East show an intermediate or high endemicity of HBV infection, which clearly poses a serious public health problem in the region [5]. For such countries, the adoption of standard precautions and HBV vaccination is required to protect HCWs from infection. In addition, non-specific preventive measures (hand cleaning, disposable medical equipment, educational campaigns and proper sterilization) are critical. Infection depletes human resources, not only as a direct result of transmission but also due to anxiety regarding safety, and poor risk reduction strategies are in place, particularly in developing countries. Furthermore, occupational health in the developing world is largely neglected and requires better description and study as an emerging concept.

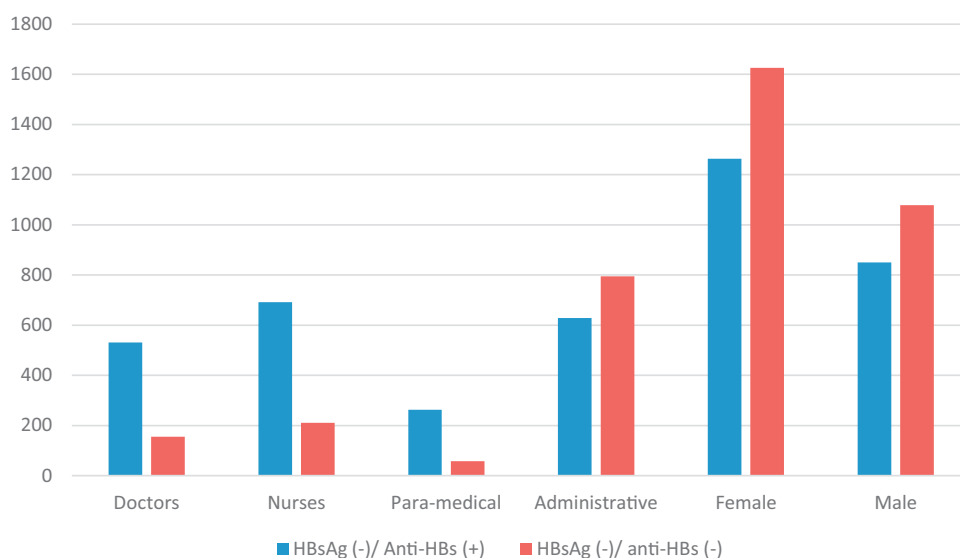
Since the hepatitis B vaccine became available, the incidence of HBV infection and the associated mortality and morbidity have declined. Therefore, in 1997, the CDC recommended that all HCWs should be vaccinated against HBV [6]. Despite this recommendation, compliance remains poor in various healthcare settings, particularly in developing countries. Furthermore, previous studies on hepatitis B among HCWs in resource-limited settings indicate variations in prevalence rates and vaccination coverage, which reflect national policies

and prevalence rates. Therefore, the situation in Libya remains unclear. Information on HBV vaccination coverage, the practice of universal precautions among HCWs, the assessment of protective levels of anti-HBs among vaccine recipients and the need for booster vaccination is scant, but this information is needed to rationalize strategies for better HBV infection control. Therefore, the aims of this study were to evaluate the susceptibility of HCWs to HBV infection in the representative Tripoli Central Hospital in Libya and determine the compliance of HCWs involved in direct patient care (physicians, nurses, and technicians) regarding HBV vaccination. Nationally appropriate policy decisions on the vaccination of health workers in Libya should be based on information on hepatitis B exposure in this group (Fig. 1).

## Methods

### Study design and setting

Between 28 February and 28 December 2011, we conducted a cross-sectional study on the HCWs of Tripoli Central Hospital, a 640-bed university-affiliated tertiary hospital located in the Center of Tripoli, Libya. A survey for anti-HBs and HBsAg was performed on 2705 HCWs across different departments in the hospital. All HCWs in these departments were invited to participate. There was no specific vaccination campaign in our hospital during the study period. We defined two categories of HCWs: HCWs in direct contact with patients



**Figure 1** Participant distribution according to gender, occupation and anti-HBs results.

(physicians, nurses, and medical and nursing assistants) and HCWs not in direct contact with patients (secretaries and administrative staff). The clinical protocol was reviewed and approved by the Board for Research Involving Human Subjects.

### Data collection and variable definitions

A standardized questionnaire designed specifically for the study was used to collect information concerning demographic characteristics (sex, age, and specific occupation) and hepatitis B vaccination status, and if applicable, reasons for the lack of vaccination were collected. Data regarding vaccination coverage were recorded on the basis of self-report. The questionnaires were completed by clinical research nurses. The questionnaire was pilot tested and reviewed for clarity before use.

### Laboratory testing

Venous blood samples were collected from every participant in accordance with universal precautions. Specimens were delinked from the participants' identity to ensure confidentiality and blinding of the laboratory staff. Serologic specimens from participants were tested for anti-HBs (Architect; Abbott Laboratories) using an ELISA. The lower limit of detection of this assay was anti-HBs  $\geq 2$  mIU/ml. Antibodies against hepatitis B core antigen (anti-HBc) were evaluated (Corzyme; Abbott Laboratories), and positive specimens were subsequently tested for hepatitis B surface antigen (HBsAg) (Auszyme Monoclonal; Abbott Laboratories) and hepatitis B core antigen (HBcAg) (Auszyme Monoclonal; Abbott Laboratories).

### Definitions

An HBV infection was defined as a positive anti-HBc or HBsAg result, as described elsewhere. A response or sero-protection was defined as an antibody titer  $\geq 10$  IU/l as the cut-off level, which correlates with protection against both acute disease and chronic hepatitis B infection, and sero-negative was defined as a concentration less than 10 mIU/ml, as indicated in the protocol of the analysis kit [7]. We defined HCWs as completely vaccinated if they had followed the Centers for Disease Control and Prevention (CDC) vaccination criteria and incompletely vaccinated if they had received at least one dose of vaccination but did not follow the CDC criteria for complete vaccination [8].

Healthcare workers who were negative for both HBs and anti-HBs were advised to receive the hepatitis B vaccine at months 0, 1, and 6. The HBV

vaccine was provided by the hospital free of cost to all the HCWs. The vaccine schedule was provided to the HCWs, and the vaccine was issued by the pharmacy department and administered by the injection room staff in the outpatient department of the Infectious Diseases Department. Those who received vaccination were reminded to return two to three months after the completion of vaccination for anti-HBs testing.

### Statistical analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS), version 17.0 for Windows (SPSS, Inc. Chicago, IL). Statistical analyses were performed using the chi-square test. The statistical significance was set at the  $P=0.05$  level.

## Results

### Population characteristics

This study included 2705 employees ranging from 17 to 74 years of age (mean: 35.5 years [SD = 9.7]), and the majority were female (60.1%). Approximately 31.2% were nurses, 25.2% were physicians, 12% were paramedics, and 29% were administrative workers. The paramedics belonged to the specialties of physiotherapy, operating room, imaging, and laboratory (Table 1).

Of the HCWs vaccinated, 82.6% (2234/2705) claimed to have received at least one dose (Engerix GlaxoSmithKline<sup>®</sup>-20  $\mu$ g) (partially vaccinated), and 72% (1950/2705) received three doses. The majority (65%) of the partly vaccinated group had not received a hepatitis B vaccine within the past 5–10 years or could only recollect that a vaccine had not been received recently. Four hundred and seventy-one subjects (17.4%) had not been vaccinated with hepatitis B vaccine. Vaccination coverage was the highest among paramedics in comparison with other job categories, as shown in the graph and Table 1.

### Anti-HBs antibody measurements

The anti-HBs titer was determined for 2704 HCWs. The anti-HBs antibody concentrations were less than 10 mIU/ml in 591 employees (21.8%), greater than or equal to 10 mIU/ml and less than 100 mIU/ml in 487 employees (18%), and greater than or equal to 100 mIU/ml in 1626 employees (60.2%). Anti-HBs levels of 1000 mIU/ml or greater

**Table 1** Participant distribution according to anti-HBs results.

	HBsAg (–)/anti-HBs (+)	HBsAg (–)/anti-HBs (–)	Total	<i>P</i> value
Gender				
• Female	1263 (77.7%)	363 (22.3%)	1626 (60.1%)	0.755
• Male	850 (78.8%)	228 (21.2%)	1078 (39.9%)	
Occupation				
• Doctors	531 (77.4%)	155 (22.6%)	686 (25.4%)	0.003
• Nurses	691 (76.6%)	211 (23.4%)	902 (33.3%)	
• Paramedics	263 (81.9%)	58 (18.1%)	321 (11.9%)	
• Administrative	628 (80%)	167 (20%)	795 (29.4%)	

were not quantified further. HCWs who had a poor immune response (anti-HBs < 10 IU/l) did not differ significantly in terms of age or sex from those who had a good immune response (anti-HBs ≥ 10 IU/l).

Table 2 shows the sero-prevalence of biological markers and the number of vaccine doses recorded in registers for 2704 healthcare workers. Two hundred and forty-three HCWs could not recall a history of hepatitis B infection.

Of the 2674 subjects who were HBsAg negative, IgG anti-HBc testing was performed in 750 subjects. A total of 130 (17.3%) subjects were positive, and hepatitis B antibody was observed, which might indicate evidence of past exposure to hepatitis B infection. Anti-HBc antibody positivity was the lowest in doctors ( $P=0.027$ ) and the highest in subordinate and casual staff ( $P=0.042$ ).

## Discussion

This study shows that 21.8% of the studied HCWs could have contracted HBV after a needle stick injury involving an HBV carrier's blood. The prevalence of hepatitis B virus (HBV) carriage in the Middle East has been reported to vary from 5 to 18% [9–11]. In some regions, however, rates of less than 5% have been reported [12]. To decrease the prevalence of HBV infection, many countries have introduced hepatitis B vaccination through

their expanded program on immunization (EPI). In Libya, hepatitis B vaccination was added to the EPI in 1993. Data from a national population-based sero-epidemiological survey showed that the overall prevalence of HBV was 2.2% [13]. To the best of our knowledge, our study is the first to analyze trends in the immunological status of hepatitis B in a population of healthcare workers in a tertiary hospital in Tripoli City, Libya. Assessing HBV vaccination coverage in the healthcare setting is needed to evaluate the proportion susceptible to HBV infection [14]. In this study, 78.2% of the HCWs were vaccinated, but 21.8% were not. The non-vaccinated HCWs most often included administrative workers and hospital attendants. We chose a threshold of sero-positivity of 10 mIU/ml, as recommended by the United States Advisory Committee on Immunization Practices and the World Health Organization [15], instead of 100 mIU/ml, which is used as the threshold in several European countries [16].

At the study hospital, HBV vaccination is not mandatory and is only recommended (and offered free) for HCWs. Therefore, it is the employee's responsibility to continue the vaccination schedule. The HBV vaccination rates among HCWs in the Middle East and other countries with low socioeconomic status have been reported to be unsatisfactory [17]. Reports from India [18,19], Pakistan [20,21], Egypt [22], Brazil [23] and Nigeria [24,25] indicate that only 16–60% of HCWs have

**Table 2** Sero-prevalence of biological markers and number of vaccine doses.

Serological markers	Number of vaccine doses reported					<i>P</i> value
	0 dose <i>N</i> (%)	1 dose <i>N</i> (%)	2 doses <i>N</i> (%)	3 doses <i>N</i> (%)	Total <i>N</i> (%)	
Naive and no Ab response (anti-HBs negative)	116 (19.6%)	58 (9.8%)	63 (10.6%)	354 (59.9%)	591	0.001
Immunized with an Ab response (anti-HBs positive)	226 (12.1%)	178 (9.5%)	135 (7.21%)	1331 (71.2%)	1870	0.0023

received complete HBV immunization. In these countries, paramedics were more often unaware of HBV/HCV transmission and received HBV vaccination less often than doctors. The practice of universal precautions, such as safe needle disposal, wearing gloves during phlebotomy and using goggles, was also suboptimal among HCWs in these countries [23,26]. Therefore, it is important to realize that in healthcare settings, pre-exposure vaccination programs are not only important for the safety of HCWs but have also proven to be cost effective relative to post-exposure prophylaxis with hyperimmunoglobulin.

The main strength of this study is that it allowed us to include all occupational categories of HCWs. Furthermore, the population was randomly selected. The participation rate was of particular interest because the study was performed in a developing country where inhabitants are not accustomed to participating in epidemiological and research studies [12]. All participants received their serological testing results with a medical interpretation. However, this study has potential limitations. HCW education and income levels as well as length of practice were not evaluated, and these characteristics may influence vaccination status [27,28].

While a national Libyan policy has not yet been implemented by the Department of Health, it is encouraging to observe that with 72% of HCWs reporting that they received 3 vaccine doses, the HBV vaccination coverage of the HCWs in this study was much higher than the 15.8% of HCWs in other developing countries [22].

In conclusion, we believe that the results of our study are directly relevant to healthcare workers. There is a need to strictly implement the policy of hepatitis B immunization in every healthcare setting as recommended by the CDC.

## Conflict of interest

*Funding:* No funding sources.

*Competing interests:* None declared.

*Ethical approval:* Not required.

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